CLAIMS:

1. A system for use in inspecting a biological tissue, the system comprising:

an imaging device configured and operable to perform two or more predetermined imaging modes and generate image data corresponding to each respective imaging mode, each imaging mode comprising at least one imaging session comprising: illumination of a selected location within a region of interest in the biological tissue by an illumination pattern comprising an exciting wavelength range selected to cause concurrent excitations of two or more different biological substances of types naturally existing in biological tissues to thereby concurrently induce auto-fluorescent responses of said two or more different biological substance; detection of a combined spectral response of said location to the illumination pattern, and generation of corresponding image data indicative of the detected combined spectral response; and

a control unit comprising an imaging mode controller operating the imaging device to perform a selected one of the imaging modes, and a data processor analyzing the image data and generating output data indicative of the biological tissue condition, wherein said imaging mode controller is configured and operable in accordance with predetermined assignment data indicative of an assignment between each of said imaging modes and at least one corresponding biological tissue condition to be inspected, said imaging mode controller being responsive to user input about the at least one biological tissue condition of user's interest to select, based on the assignment data, respective imaging mode data and generate corresponding operational data to operate the imaging device to perform the at least one imaging session of the respective imaging mode.

2. The system of claim 1, wherein said exciting wavelength range has a spectral width substantially not exceeding 100nm.

3. The system of claim 1 or 2, wherein the illumination pattern of each of the imaging modes comprises the exciting wavelength range containing at least one exciting wavelength selected to excite and cause auto-fluorescent responses of the different biological substances including two or more biological auto-fluorescent spectral agents (BASAs), whose concurrent presence in the selected location in the biological tissue presents a direct indication of a certain pathological condition of the biological tissue.

4. The system of any one of claims 1 to 3, wherein the imaging device comprises: a light source unit configured and operable by operational data generated by the imaging

mode controller to produce said illumination pattern corresponding to the selected imaging mode.

5. The system of any one of claims 1 to 4, wherein the imaging device comprises focusing and imaging arrangements configured and operable to collect the combined spectral response from the selected location.

6. The system of any one of the preceding claims, wherein said imaging device comprises an image detector comprising a color camera device configured for concurrently detecting the plurality of auto-fluorescent responses of different wavelengths.

7. The system of claim 6, wherein said color camera device comprises a pixel matrix configured and operable to define multiple detection channels of different colors, such that the image data is indicative of different detected wavelengths of said combined response and corresponding location data in the biological tissue where said different detected wavelengths are originated.

8. The system of claim 6 or 7, wherein said color camera is configured with collection channels of primary colors.

9. The system of any one of claims 6 to 8, wherein said data processor is configured and operable to receive and process the image data and identify, in said image data, image data pieces corresponding to the different emission wavelengths contained in said detected combined response, and determine a relation between said image data pieces to identify the corresponding location data in the biological tissue where said different emission wavelengths are originated.

10. The system of any one of the preceding claims, wherein the illumination pattern comprises one or more illumination pulses of light comprising the selected exciting wavelength range.

11. The system of any one of claims 3 to 10, wherein the illumination mode comprises the illumination pattern assigned to the pathological condition identifiable by the presence in the predetermined location of the two or more BASAs comprising two or more of the following: albumin, elastin, collagen, lipofuscin, fatty acids, LDL, NADH, flavins, porphyrins, amyloid and AGEs.

12. The system according to any one of the preceding claims, wherein the illumination pattern comprises at least one additional exciting wavelength range selected to excite at least one additional biological substance to cause at least one additional fluorescent

response of said at least one additional biological substance to be included in said detected combined spectral response.

13. The system according to any one of the preceding claims, wherein said combined spectral response comprises the auto-fluorescent responses of the different biological substances excited by the exciting wavelength range, and reflection of one or more of wavelengths of the illumination pattern from structures in the biological tissue being illuminated.

14. The system of claim 12, wherein the illumination pattern includes one or more visualization wavelengths selected to enhance imaging of blood vessels in vicinity of the location being imaged, such that the image data includes a combined image of the blood vessels and said two or more excited substances.

15. The system of claim 14, wherein said one or more visualization wavelengths includes one or more exciting wavelengths selected to excite substances associated with blood vessel structures.

16. The system of claim 15, wherein said one or more visualization wavelengths includes at least one of 436nm, 517nm and 660nm wavelengths.

17. The system of claim 16, wherein the illumination pattern includes 350nm wavelength for exciting elastin and collagen substances.

18. The system according to any one of the preceding claims, wherein said assignment data comprises data indicative of pathological condition relating to diabetic retinopathy (DR) assigned with the one or more imaging mode to be performed on the location in a retina region utilizing comprising at least one of the following:

(a) the illumination pattern comprising the exciting wavelength range comprising 385nm and 400nm wavelengths selected to induce simultaneous auto-fluorescence response of AGEs and plasma substances,

(b) the illumination pattern comprising the exciting wavelength range comprising 365nm and 430nm wavelengths selected to induce simultaneous auto-fluorescence response of NADH and flavoproteins substances.

19. The system according to any one of the preceding claims, wherein said assignment data comprises data indicative of pathological condition relating to macular degeneration (AMD) assigned with the one or more imaging mode to be performed on the location in a retina region comprising the exciting wavelength range including 350nm wavelength

selected to induce simultaneous auto-fluorescence responses of amyloid and fatty acids substances.

20. The system according to any one of the preceding claims, wherein said assignment data comprises data indicative of pathological condition relating to proliferative diabetic retinopathy (DR) assigned with the one or more imaging mode to be performed on the location in a cornea region comprising the exciting wavelength range including 385nm and 430nm wavelengths selected to induce simultaneous auto-fluorescence responses of AGE and flavoproteins substances.

21. A method for use in inspection of biological tissue, the method comprising:

providing predetermined assignment data comprising a plurality of *k* pathological conditions PC_1 ... PC_K, each i-th pathological condition PC_i of said *k* pathological conditions being assigned with a respective at least one i-th imaging mode data defining imaging to be performed on at least one respective location within the biological tissue and being characterized by at least one respective i-th illumination pattern, each comprising a corresponding i-th exciting wavelength range which is selected to induce substantially simultaneous auto-fluorescent responses of a predetermined set of two or more different biological auto-fluorescent spectral agents (BASAs) whose concurrent presence in the selected location in the biological tissue presents a direct indication of said i–th pathological condition PC_i of the biological tissue;

in response to user input about the i-th pathological condition to be inspected for in the biological tissue, selecting, in said assignment data, the respective i-th imaging mode data, and generating corresponding operational data to an imaging device to implement said imaging mode in at least one imaging session on said predetermined location and detect a combined spectral response of said location to the illumination pattern, and generate corresponding image data indicative of the detected combined spectral response; and

processing the image data and providing output data about said i-th pathological condition.

22. The method of claim 21, wherein said detection of the combined spectral response is performed by a color camera device configured for concurrently detecting the plurality of auto-fluorescent responses of different emission wavelengths.

23. The method of claim 22, wherein said detection comprises collecting the combined spectral response by a pixel matrix defining multiple detection channels of

different colors, such that the image data is indicative of different detected wavelengths of said combined spectral response and corresponding location data in the biological tissue where said different detected wavelengths are originated.

24. The method of claim 21 or 22, wherein said processing of the image data comprises identifying, in said image data, image data pieces corresponding to the different wavelengths contained in said detected combined spectral response, and determining a relation between said image data pieces to identify the corresponding location data in the biological tissue where said different detected wavelengths are originated.

25. The method of any one of claims 21 to 24, wherein the illumination pattern includes one or more visualization wavelengths selected to enhance imaging of blood vessels in vicinity of the location being imaged, such that the image data includes a combined image of the blood vessels and said two or more excited substances.

26. The method of claim 25, wherein said one or more visualization wavelengths includes one or more exciting wavelengths selected to excite substances associated with blood vessel structures.

27. The system of claim 26, wherein said one or more visualization wavelengths includes at least one of 436nm, 517nm and 660nm wavelengths.

28. The system of claim 27, wherein the illumination pattern includes 350nm wavelength for exciting elastin and collagen substances.

29. The method according to any one of claims 21 to 28, wherein said assignment data comprises data indicative of pathological condition relating to diabetic retinopathy (DR) assigned with the one or more imaging mode to be performed on the location in a retina region utilizing comprising at least one of the following:

(a) the illumination pattern comprising the exciting wavelength range comprising 385nm and 400nm wavelengths selected to induce simultaneous auto-fluorescence response of AGEs and plasma substances,

(b) the illumination pattern comprising the exciting wavelength range comprising 365nm and 430nm wavelengths selected to induce simultaneous auto-fluorescence response of NADH and flavoproteins substances.

30. The method according to any one of claims 21 to 29, wherein said assignment data comprises data indicative of pathological condition relating to macular degeneration (AMD) assigned with the one or more imaging mode to be performed on the location in

a retina region comprising the exciting wavelength range including 350nm wavelength selected to induce simultaneous auto-fluorescence responses of amyloid and fatty acids substances.

31. The system according to any one of claims 21 to 30, wherein said assignment data comprises data indicative of pathological condition relating to proliferative diabetic retinopathy (DR) assigned with the one or more imaging mode to be performed on the location in a cornea region comprising the exciting wavelength range including 385nm and 430nm wavelengths selected to induce simultaneous auto-fluorescence responses of AGE and flavoproteins substances.

32. A method for inspecting a biological tissue for one or more pathological conditions, the method comprising:

illuminating a predetermined location within the biological tissue by an illumination pattern comprising a predetermined exciting wavelength range comprising a predetermined number N ($N \geq 1$) of predetermined exciting wavelengths selected to substantially concurrently induce two or more auto-fluorescent responses of two or more predetermined different biological substances of types naturally existing in biological tissues; and

detecting a combined spectral response of the biological tissue to said illumination pattern; and upon identifying in said detected combined spectral response emission wavelengths of said two or more substances, generating data indicative of said pathological condition.

CLAIMS:

1. A system for use in inspecting a biological tissue, the system comprising:

an imaging device configured and operable to perform two or more predetermined imaging modes and generate image data corresponding to each respective imaging mode, each imaging mode comprising at least one imaging session comprising: illumination of a selected location within a region of interest in the biological tissue by an illumination pattern comprising an exciting wavelength range selected to cause concurrent excitations of two or more different biological substances of types naturally existing in biological tissues to thereby concurrently induce auto-fluorescent responses of said two or more different biological substance; detection of a combined spectral response of said location to the illumination pattern, and generation of corresponding image data indicative of the detected combined spectral response; and

a control unit comprising an imaging mode controller operating the imaging device to perform a selected one of the imaging modes, and a data processor analyzing the image data and generating output data indicative of the biological tissue condition, wherein said imaging mode controller is configured and operable in accordance with predetermined assignment data indicative of an assignment between each of said imaging modes and at least one corresponding biological tissue condition to be inspected, said imaging mode controller being responsive to user input about the at least one biological tissue condition of user's interest to select, based on the assignment data, respective imaging mode data and generate corresponding operational data to operate the imaging device to perform the at least one imaging session of the respective imaging mode.

2. The system of claim 1, characterized by at least one of the following:

said illuminating pattern of each of the imaging modes comprises exciting wavelength range having a spectral width substantially not exceeding 100nm;

the illumination pattern of each of the imaging modes comprises the exciting wavelength range containing at least one exciting wavelength selected to excite and cause auto-fluorescent responses of the different biological substances including two or more biological auto-fluorescent spectral agents (BASAs);

the illumination pattern of each of the imaging modes comprises one or more illumination pulses of light comprising the selected exciting wavelength range;

the illumination pattern of each of the imaging modes comprises at least one additional exciting wavelength range selected to excite at least one additional biological substance to cause at least one additional fluorescent response of said at least one additional biological substance to be included in said detected combined spectral response.

3. The system of claim 2, wherein the illumination pattern of each of the imaging modes comprises the exciting wavelength range containing at least one exciting wavelength selected to excite and cause auto-fluorescent responses of the different biological substances including two or more biological auto-fluorescent spectral agents (BASAs), whose concurrent presence in the selected location in the biological tissue presents a direct indication of a certain pathological condition of the biological tissue.

4. The system of any one of claims 1 to 3, wherein the imaging device comprises: a light source unit configured and operable by operational data generated by the imaging mode controller to produce said illumination pattern corresponding to the selected imaging mode; and an image detector configured and operable to collect the combined spectral response from the selected location.

5. The system of any one of claims 1 to 4, wherein the imaging device comprises a focusing arrangements.

6. The system of claim 4 or 5, wherein said image detector comprises a color camera device configured for concurrently detecting the plurality of auto-fluorescent responses of different wavelengths.

7. The system of claim 6, wherein said color camera device has at least one of the following configurations:

said color camera device comprises a pixel matrix configured and operable to define multiple detection channels of different colors, such that the image data is indicative of different detected wavelengths of said combined response and corresponding location data in the biological tissue where said different detected wavelengths are originated;

said color camera is configured with collection channels of primary colors.

8. The system of claim 6 or 7, wherein said data processor is configured and operable to receive and process the image data and identify, in said image data, image data pieces corresponding to the different emission wavelengths contained in said detected combined response, and determine a relation between said image data pieces to identify the

corresponding location data in the biological tissue where said different emission wavelengths are originated.

9. The system of any one of claims 3 to 8, wherein the illumination mode comprises the illumination pattern assigned to the pathological condition identifiable by the presence in the predetermined location of the two or more BASAs comprising two or more of the following: albumin, elastin, collagen, lipofuscin, fatty acids, LDL, NADH, flavins, porphyrins, amyloid and AGEs.

10. The system according to any one of the preceding claims, wherein said combined spectral response comprises the auto-fluorescent responses of the different biological substances excited by the exciting wavelength range, and reflection of one or more of wavelengths of the illumination pattern from structures in the biological tissue being illuminated.

11. The system of claim 10, wherein the illumination pattern includes one or more visualization wavelengths selected to enhance imaging of blood vessels in vicinity of the location being imaged, such that the image data includes a combined image of the blood vessels and said two or more excited substances.

12. The system of claim 11, wherein said one or more visualization wavelengths includes one or more exciting wavelengths selected to excite substances associated with blood vessel structures.

13. The system of claim 12, wherein said one or more visualization wavelengths includes at least one of 436nm, 517nm and 660nm wavelengths.

14. The system of claim 13, wherein the illumination pattern includes 350nm wavelength for exciting elastin and collagen substances.

15. The system according to any one of the preceding claims, wherein said assignment data is characterized by at least one of the following:

(i) the assignment data comprises data indicative of pathological condition relating to diabetic retinopathy (DR) assigned with the one or more imaging mode to be performed on the location in a retina region utilizing comprising at least one of the following: **(a)** the illumination pattern comprising the exciting wavelength range comprising 385nm and 400nm wavelengths selected to induce simultaneous auto-fluorescence response of AGEs and plasma substances, **(b)** the illumination pattern comprising the exciting wavelength range comprising 365nm and 430nm wavelengths selected to induce simultaneous auto-fluorescence response of NADH and flavoproteins substances;

(ii) the assignment data comprises data indicative of pathological condition relating to macular degeneration (AMD) assigned with the one or more imaging mode to be performed on the location in a retina region comprising the exciting wavelength range including 350nm wavelength selected to induce simultaneous auto-fluorescence responses of amyloid and fatty acids substances;

(iii) the assignment data comprises data indicative of pathological condition relating to proliferative diabetic retinopathy (DR) assigned with the one or more imaging mode to be performed on the location in a cornea region comprising the exciting wavelength range including 385nm and 430nm wavelengths selected to induce simultaneous auto-fluorescence responses of AGE and flavoproteins substances.

16. A method for use in inspection of biological tissue, the method comprising:

providing predetermined assignment data comprising a plurality of *k* pathological conditions PC_1 … PC_K, each i-th pathological condition PC_i of said *k* pathological conditions being assigned with a respective at least one i-th imaging mode data defining imaging to be performed on at least one respective location within the biological tissue and being characterized by at least one respective i-th illumination pattern, each comprising a corresponding i-th exciting wavelength range which is selected to induce substantially simultaneous auto-fluorescent responses of a predetermined set of two or more different biological auto-fluorescent spectral agents (BASAs) whose concurrent presence in the selected location in the biological tissue presents a direct indication of said i–th pathological condition PC_i of the biological tissue;

in response to user input about the i-th pathological condition to be inspected for in the biological tissue, selecting, in said assignment data, the respective i-th imaging mode data, and generating corresponding operational data to an imaging device to implement said imaging mode in at least one imaging session on said predetermined location and detect a combined spectral response of said location to the illumination pattern, and generate corresponding image data indicative of the detected combined spectral response; and

processing the image data and providing output data about said i-th pathological condition.

17. The method of claim 16, characterized by at least one of the following:

said detection of the combined spectral response is performed by a color camera device configured for concurrently detecting the plurality of auto-fluorescent responses of different emission wavelengths;

said processing of the image data comprises identifying, in said image data, image data pieces corresponding to the different wavelengths contained in said detected combined spectral response, and determining a relation between said image data pieces to identify the corresponding location data in the biological tissue where said different detected wavelengths are originated.

18. The method of claim 17, wherein said detection of the combined spectral response is performed by a color camera device configured for concurrently detecting the plurality of auto-fluorescent responses of different emission wavelengths, said detection comprising collecting the combined spectral response by a pixel matrix defining multiple detection channels of different colors, such that the image data is indicative of different detected wavelengths of said combined spectral response and corresponding location data in the biological tissue where said different detected wavelengths are originated.

19. The method of any one of claims 16 to 18, wherein the illumination pattern includes one or more visualization wavelengths selected to enhance imaging of blood vessels in vicinity of the location being imaged, such that the image data includes a combined image of the blood vessels and said two or more excited substances.

20. The method of claim 19, wherein said one or more visualization wavelengths includes one or more exciting wavelengths selected to excite substances associated with blood vessel structures.

21. The system of claim 20, wherein said one or more visualization wavelengths includes at least one of 436nm, 517nm and 660nm wavelengths.

22. The system of claim 21, wherein the illumination pattern includes 350nm wavelength for exciting elastin and collagen substances.

23. The method according to any one of claims 16 to 22, wherein said assignment data has at least one of the following configurations:

(i) the assignment data comprises data indicative of pathological condition relating to diabetic retinopathy (DR) assigned with the one or more imaging mode to be performed on the location in a retina region utilizing comprising at least one of the following: **(a)** the illumination pattern comprising the exciting wavelength range comprising 385nm and 400nm wavelengths selected to induce simultaneous auto-fluorescence response of AGEs

and plasma substances, **(b)** the illumination pattern comprising the exciting wavelength range comprising 365nm and 430nm wavelengths selected to induce simultaneous auto-fluorescence response of NADH and flavoproteins substances;

(ii) assignment data comprises data indicative of pathological condition relating to macular degeneration (AMD) assigned with the one or more imaging mode to be performed on the location in a retina region comprising the exciting wavelength range including 350nm wavelength selected to induce simultaneous auto-fluorescence responses of amyloid and fatty acids substances;

(iii) the assignment data comprises data indicative of pathological condition relating to proliferative diabetic retinopathy (DR) assigned with the one or more imaging mode to be performed on the location in a cornea region comprising the exciting wavelength range including 385nm and 430nm wavelengths selected to induce simultaneous auto-fluorescence responses of AGE and flavoproteins substances.